

Documentation for Updated Office of Research and Standards Guidelines (ORSG) for Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water

PFAS included¹: Perfluorooctane Sulfonic Acid (PFOS) Perfluorooctanoic Acid (PFOA) Perfluorohexane Sulfonic Acid (PFHxS) Perfluorononanoic Acid (PFNA) Perfluoroheptanoic Acid (PFHpA) Perfluorodecanoic Acid (PFDA)	CASRN: 1763-23-1 335-67-1 355-46-4 375-95-1 375-85-9 335-76-2	Update: January 2020
¹ The compounds and associated CAS registry numbers (CASRN) listed refer to the acid form of these PFAS compounds. The information presented in this document and the ORSG are also applicable to the respective anionic forms of these compounds. These anions may form salts with any of a number of cations resulting in a variety of possible chemical species, each having a unique CASRN.		
Updated ORSG: 0.000020 mg/L (20 ppt). When all or some of the listed compounds occur together in drinking water, the detected concentrations for these PFAS should be summed and compared to 0.000020 mg/L. This value is also applicable to the individual compounds.		
Federal Regulatory Limit: The US EPA has not published an MCL for any of these PFAS.		
<p><u>Basis for Criteria - Non-Cancer Health Risk:</u></p> <p>In consideration of recent PFAS assessments by other organizations and states, and new data, MassDEP ORS reassessed the toxicity values and ORSGs for the PFAS compounds in the noted subgroup. This reassessment reflects public comments received on the draft Massachusetts Contingency Plan (MCP) PFAS standards issued for public comment on April 19, 2019, as well as technical input from the MassDEP Health Effects Advisory Committee. Detailed supporting information can be found in the Technical Support Document Per- and Polyfluoroalkyl Substances (PFAS): An Updated Subgroup Approach to Groundwater and Drinking Water Values (the TSD) (https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas#development-of-a-pfas-drinking-water-standard-(mcl)-).</p> <p>In summary, MassDEP ORS concluded that the toxicity value (RfD) for compounds in this subgroup of longer-chain PFAS should be adjusted downward from that used in the 2018 ORSG derivation, to 5 x 10⁻⁶ milligrams per kilogram body weight per day (mg/kg-day). The revised MassDEP RfD value results from the application of an additional uncertainty factor (UF) of 10^{1/2} in the RfD derivations for PFOA and PFOS as detailed in the TSD. This was done to account for considerable and convincing evidence associating exposures to these compounds with adverse responses in laboratory animals at levels of exposure lower than those used to derive the previous RfD. ORS also concluded that one additional compound, PFDA, should be included in the subgroup, based on structural and toxicological similarity. As discussed in the</p>		

TSD the revised MassDEP ORS RfD is applied to the noted subgroup of six closely-related PFAS. Based on their close structural similarities, similar toxicities and long half-lives, MassDEP ORS also concluded that it is appropriate to treat these six compounds additively.

Application of the revised RfD, using the same water ingestion rate and body weight parameters for a lactating woman (i.e., a water ingestion rate of 54 mL/kg-day) and relative source contribution factor of 0.2 previously applied, results in an ORSG of 20 ppt.

Cancer Risk:

MassDEP ORS also considered the potential carcinogenicity of these compounds. A study of people exposed to PFOA and other PFAS concluded that the data supported a probable link between exposure and cancers of the kidney and testes (Barry et al. 2013). No potency estimates were derived. Animal bioassay data from the NTP (NTP 2019c) reported elevated pancreatic and liver tumor rates following high dose exposures to PFOA. Although NTP has issued summary data tables for this study, a final report has not been issued and, as of June 29, 2019, no agency had established drinking water values based on this data. The cancer data is concerning to MassDEP, because some carcinogens can present a degree of risk at any exposure level. To account for this potential risk, MCL goals (MCLGs) of zero have been established by US EPA for some chemicals and may ultimately be warranted for certain PFAS. MCLGs are guidance values rather than standards and are levels of a contaminant in drinking water at or below which there is no known or expected risk to health. At this time, however, the level of cancer risk posed by these compounds is unclear.

Though data on carcinogenicity are not available for PFHxS, PFNA, PFHpA and PFDA, given the similarities in structure and toxicity of these PFAS to PFOA and PFOS, the potential for the carcinogenicity of these other PFAS cannot be ruled out.

MassDEP ORS will follow and assess research in this area to determine if future revisions to the drinking water values are needed.

Class: Organic

Analytical Information:

Analytical Methods: US EPA Method 537 (US EPA, 2009)
US EPA Method 537.1 (US EPA, 2018)

Laboratories should achieve a MRL of 2 ppt.

Analytical methods may have been updated since this guidance value was last revised. Updated analytical methods for drinking water may be found at <https://www.epa.gov/measurements-modeling/collection-methods#2>

Other Information:

Information and data (e.g. Health Advisories (HAs), RfDs, cancer assessments or cancer potency factors (CPFs) referenced in this document pertain to the derivation of the current guidance value and may not reflect the most current information. Updated information may be available from the following sources:

HAs – The US EPA provides guidance for shorter-term exposures for chemicals based on their non-cancer effects. More current HAs may be found at <https://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf>.

RfDs, cancer assessments and CPFs – For specific information pertaining to derivation of drinking water criteria, consult the Federal Register notice that announces the availability of the most current guidance for that chemical. In addition, information on other current RfDs and CPFs as well as cancer assessments for specific chemicals may be found in the US EPA Integrated Risk Information System (IRIS) at <https://www.epa.gov/iris>. Please note that the information in IRIS may differ from that used in the derivation process as published in the Federal Register notice.

References:

Lau, C., J.R. Thibodeaux, R.G. Hanson, M.G. Narotsky, J.M. Rogers, A.B. Lindstrom, and M.J. Strynar (2006). Effects of perfluorooctanoic acid exposure during pregnancy in the mouse. *Toxicological Sciences* 90:510–518.

Luebker, D.J., R.G. York, K.J. Hansen, J.A. Moore, and J.L. Butenhoff (2005a). Neonatal mortality from in utero exposure to perfluorooctanesulfonate (PFOS) in Sprague-Dawley rats: Dose-response and biochemical and pharmacokinetic parameters. *Toxicology* 215:149–169.

Luebker, D.J., M.T. Case, R.G. York, J.A. Moore, K.J. Hansen, and J.L. Butenhoff (2005b). Two-generation reproduction and cross-foster studies of perfluorooctanesulfonate (PFOS) in rats. *Toxicology* 215:126–148.

MassDEP (2019). Massachusetts Department of Environmental Protection (MassDEP). Technical Support Document - Per- and Polyfluoroalkyl Substances (PFAS): An Updated Subgroup Approach to Groundwater and Drinking Water Values. Office of Research and Standards.

US EPA (2005). United States Environmental Protection Agency. Guidelines for Carcinogen Risk Assessment. Risk Assessment Forum. EPA/630/P-03/001B.

US EPA (2009). United States Environmental Protection Agency. Method 537, Determination of Selected Perfluorinated Alkyl Acids in Drinking Water By Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) Version 1. US EPA, Office of Research and Development, National Exposure Research Laboratory. EPA/600/R-08/092.

US EPA. (2016a). United States Environmental Protection Agency. Drinking Water Health

Advisory for Perfluorooctanoic Acid (PFOA) and Health Effects Support Document for Perfluorooctanoic Acid (PFOA). US EPA Office of Water. EPA 822-R-16-005

US EPA. (2016b). United States Environmental Protection Agency. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and Health Effects Support Document for Perfluorooctane Sulfonate (PFOS). US EPA Office of Water. EPA 822-R-16-004.